North Coast Watershed Assessment Program

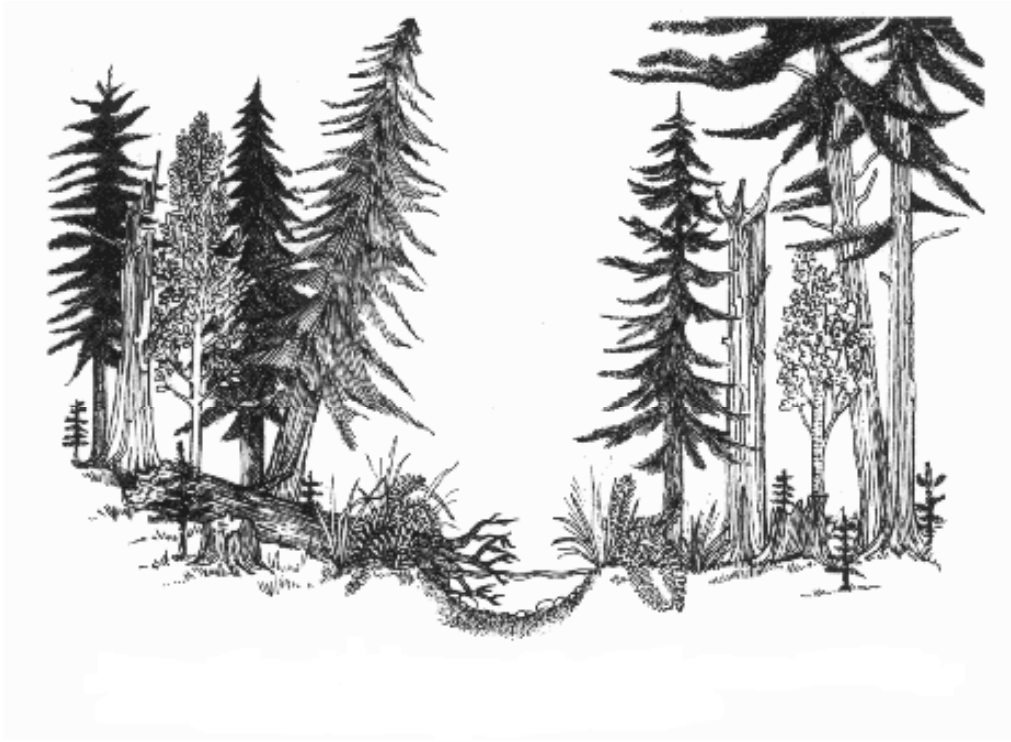
DRAFT

Mattole Watershed Synthesis Report

The mission of the North Coast Watershed Assessment Program is to conserve and improve California's north coast anadromous salmonid populations by conducting, in cooperation with public and private landowners, systematic multi-scale assessments of watershed conditions to determine factors affecting salmonid production and recommend measures for watershed improvements.

Public Review Draft - March 22, 2002

Eastern Mattole Subbasin

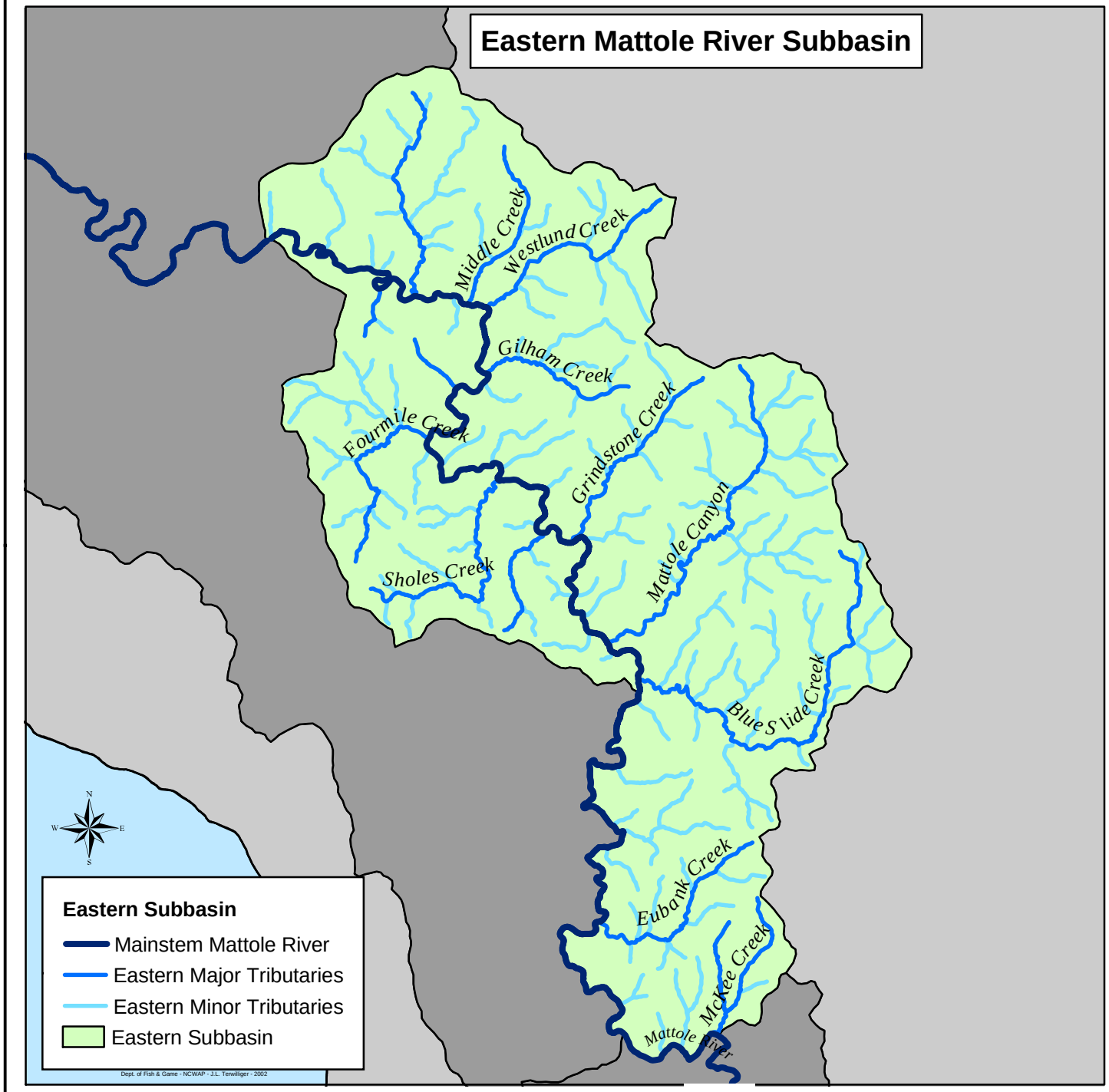


Introduction

The Eastern subbasin is located between Honeydew Creek (River Mile 26.5) and Bridge Creek (River Mile 52.1) along the eastern side of Wilder Ridge, and the Mattole mainstem above Bear Creek, for a distance of about 25.6 river miles (see map on following page). There are fifteen perennial streams that drain a watershed area of 79 square miles. The DFG has recently surveyed 22.2 miles of the subbasin's anadromous reaches. Elevations range from 344 feet at Honeydew Creek to approximately 2,300 feet in the headwaters of the tributaries.

Climate

The Eastern subbasin has the highest rainfall averages, ranging from 85 inches near Thorn Junction to 115 inches in the hills east of Honeydew. Temperatures are typical of other inland areas of California with sub-freezing winter temperatures and above 100° F summer temperatures.


Eastern Mattole River Subbasin
Middle Creek
Westlund Creek
Gilham Creek
Fourmile Creek
Grindstone Creek
Mattole Canyon
Sholes Creek
Blue Slide Creek
Eubank Creek
McKee Creek
Mattole River
N
W
E
S
Eastern Subbasin
Mainstem Mattole River
Eastern Major Tributaries
Eastern Minor Tributaries
Eastern Subbasin
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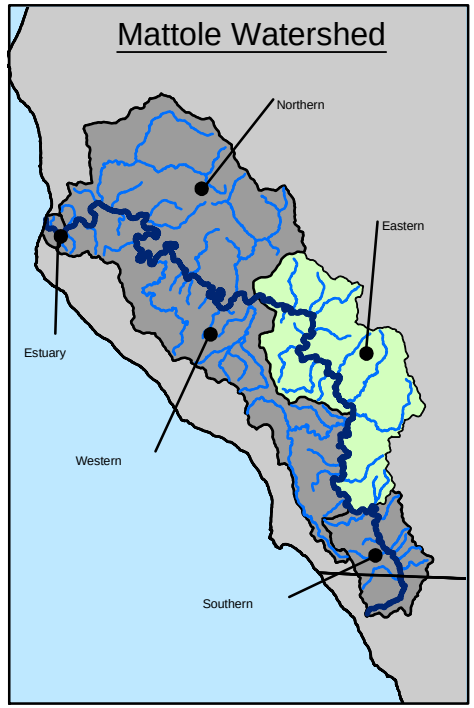
Mattole Watershed
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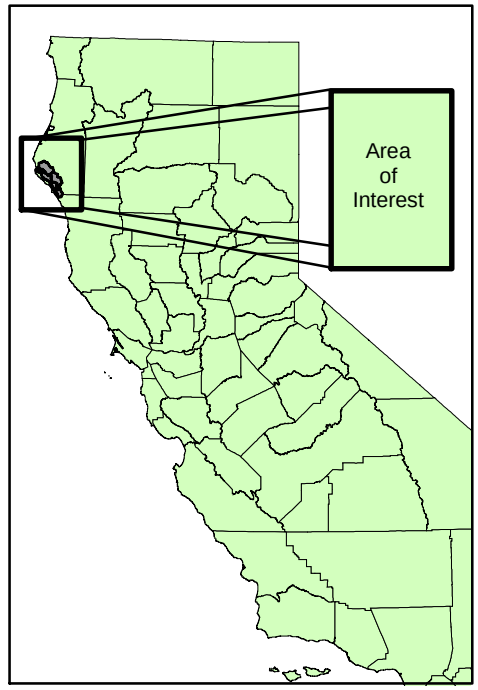
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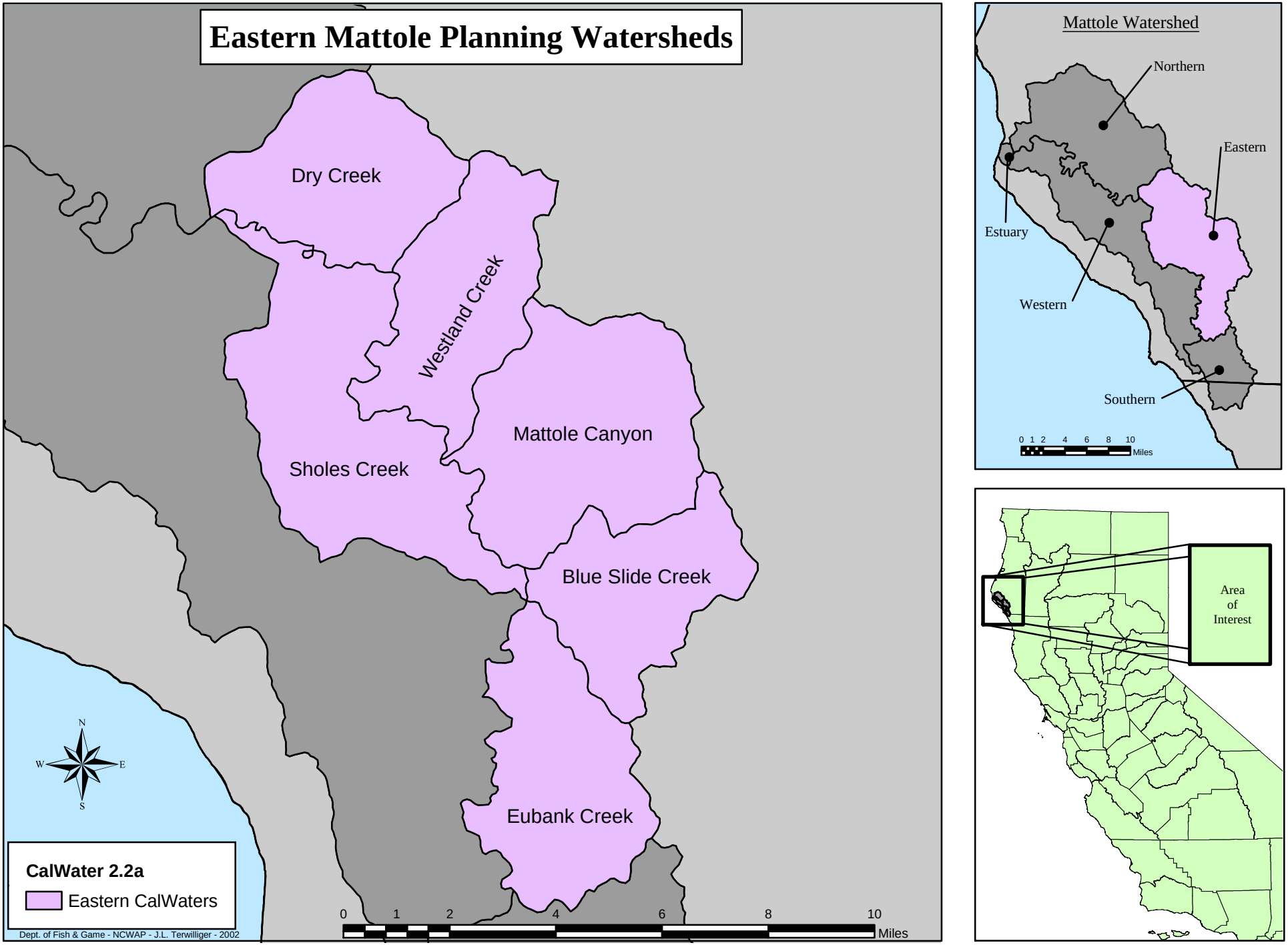
Eastern Mattole Planning Watersheds
Dry Creek
Westland Creek
Mattole Canyon
Sholes Creek
Blue Slide Creek
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Eastern CalWaters
Dept. of Fish & Game - NCWAP - J.L. Terwilliger - 2002
0 1 2 4 6 8 10
Miles
Mattole Watershed
Northern
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0 1 2 4 6 8 10
Miles
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Hydrology

The Eastern subbasin is made up of six complete Calwater Units (see map on the previous page). There are 54.0 perennial stream miles in 15 perennial tributaries in this subbasin (Table 22). Thirteen of these tributaries have been inventoried by the DFG. There were 18 reaches, totaling 31.1 miles in the inventory surveys. The inventories included channel and habitat typing, and biological sampling.

Table 22: Surveyed Streams with Estimated Anadromy in the Eastern Subbasin.

Stream	DFG Survey (Y/N)	DFG Survey Length (miles)	Estimated Anadromous Habitat Length (miles)	Reach	Channel Type
Dry Creek	Y	1.6	3.0	1	F4
Middle Creek	Y	1.4	2.1	1	B4
Westlund Creek	Y		3.1		
	Y	2.3		1	B4
	Y	0.9		2	A4
Gilham Creek	Y	1.9		1	B4
	Y	0.7		2	A3
Duncan Creek	N				
Fourmile Creek	Y		3.1		
	Y	0.5		1	C4
	Y	0.7		2	A4
Sholes Creek	Y	4.0	2.0	1	B4
Harrow Creek	Y	0.2	0.2	1	B3
Grindstone Creek	Y	2.6	0.3	1	B4
Mattole Caynon	N		6.0		
Blue Slide Creek	Y	6.3	7.0	1	F4
Fire Creek	Y	2.0		1	F4
Deer Lick Creek	N				
Eubanks Creek	Y		3.2		
	Y	3.0		1	B1
	Y	0.3		2	B4
Sinkyone Creek	N				
McKee Creek	Y		2.1		
	Y	0.7		1	B3
	Y	1.5		2	F4
Painter Creek	Y	0.3	1.1	1	F4

In their inventory surveys, the DFG crews utilize a channel classification system developed by David Rosgen (1994) and described in the *California Salmonid Stream Habitat Restoration Manual* (Flosi, et al., 1998). Rosgen channel typing describes relatively long stream reaches using eight channel features: channel width, depth, velocity, discharge, channel slope, roughness of channel materials, sediment load and sediment size. There are eight general channel types in the Rosgen classification system.

In the Eastern subbasin, there were three type A channels, totaling 2.3 miles; eight type B channels, totaling 16.4 miles; one type C channel, totaling 0.5 miles; and five type F channels, totaling 11.7 miles. Type A stream reaches are narrow, moderately deep, single thread channels. They are entrenched, high gradient reaches with step/pool sequences. Type A reaches flow through steep V-shaped valleys, do not have well-developed floodplains, and have few meanders. Type B stream reaches are wide, shallow, single thread channels. They are moderately entrenched, moderate to steep gradient reaches, which are riffle-dominated with step/pool sequences. Type B reaches flow through broader valleys than type A reaches, do not have well-developed floodplains, and have few meanders.

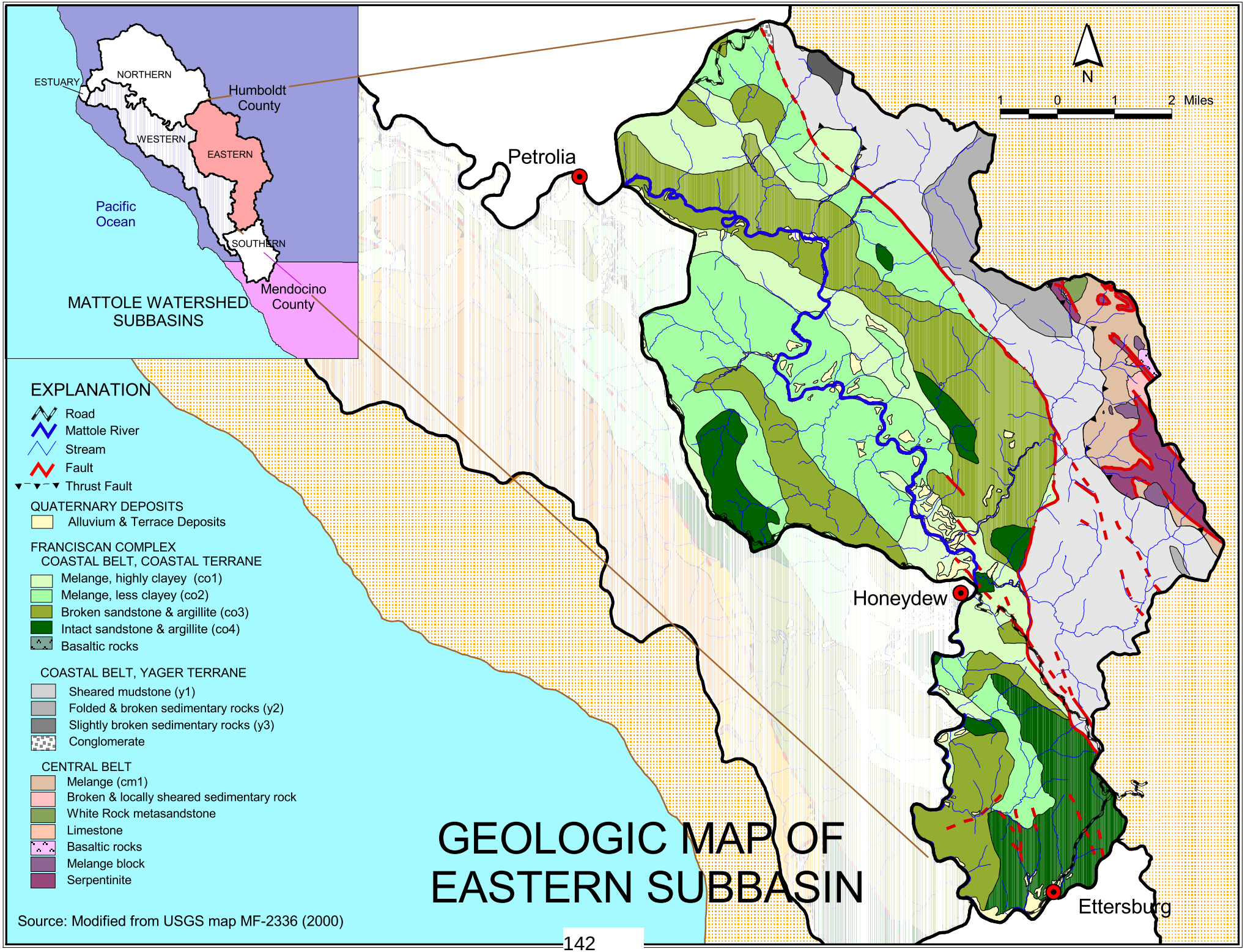
Type C stream reaches are wide, shallow, single thread channels. They are moderately entrenched, low gradient reaches with riffle/pool sequences. Type C reaches have well-developed floodplains, meanders, and point bars. Type F stream reaches are wide, shallow, single thread channels. They are deeply entrenched, low gradient reaches and often have high rates of bank erosion. Type F reaches flow through low-relief valleys and gorges, are typically working to create new floodplains, and have frequent meanders (Flosi, et al., 1998).

Geology

The geology of the Eastern subbasin encompasses the widest range of bedrock types and structure in the watershed, including portions of the Coastal terrane, Yager terrane, and Coastal belt mélange, along with the fault zones that form the boundaries between the terranes. Correspondingly, relative slope stability and geomorphology vary widely within the subbasin. In general, the bedrock may be described as relatively intact and stable material forming hard and moderate terrains. These intact units are locally interrupted by northwest-trending zones of sheared mélange and faulting where the rock is much weaker. These zones forms soft terrain, are susceptible to slope instability. As with other areas in the watershed, grasslands areas impacted by earthflows, soil creep, and excessive gully erosion tend to develop in the soft topography of the mélange matrix and fault/shear zones. These conditions are found along a broad shear zone that extends to the southeast from Honeydew, along Pringle Ridge and on across the Mattole river near Duncan Creek. Similar conditions are found in the upper reaches of Mattole Canyon Creek and Blue Slide Creek where several fault zones and Coastal belt mélange are present. The terrain distribution for the entire Mattole Watershed is presented on maps within the *Mattole Watershed Profile – Geology* section of this report.

Large dormant landslides and landslide complexes, and large active landslides generally occur in the soft and to a lesser degree moderate terrain, with more of the moderate sized dormant and small active landslides occurring in the moderate terrain. Moderate sized dormant and small active landslides are scattered throughout the hard terrain. Steep forested slopes, locally impacted by active debris slides and occasional large, deep-seated landslides that are for the most part dormant are typical of areas of more intact bedrock. Debris slide slopes are mapped extensively throughout much of the hard terrain, and locally with lower density and concentration within the moderate terrain. Debris slide slopes are rare in the soft terrain. The landslide occurrence on the three terrains is presented on maps within the *Mattole Watershed Profile – Geology* section of this report.

Based on the concentration of large landslides and the inherent weakness of the mélange matrix and fault/shear zones, most of this soft terrain has been interpreted as having a very high landslide potential. The moderate terrain has been mapped mostly with moderate landslide potential, whereas with the areas underlain by moderate sized dormant and active landslides and debris slide slopes fall into the high to very high category. The hard terrain has been interpreted mostly to have a moderate landslide potential with areas of very high potential underlain by active or dormant landslide.


ESTUARY
NORTHERN
Humboldt County
WESTERN
EASTERN
Pacific Ocean
SOUTHERN
Mendocino County
MATTOLE WATERSHED SUBBASINS
N
1 0 1 2 Miles
Petrolia
Honeydew
Ettersburg
EXPLANATION
Road
Mattole River
Stream
Fault
Thrust Fault
QUATERNARY DEPOSITS
Alluvium & Terrace Deposits
FRANCISCAN COMPLEX
COASTAL BELT, COASTAL TERRANE
Melange, highly clayey (co1)
Melange, less clayey (co2)
Broken sandstone & argillite (co3)
Intact sandstone & argillite (co4)
Basaltic rocks
COASTAL BELT, YAGER TERRANE
Sheared mudstone (y1)
Folded & broken sedimentary rocks (y2)
Slightly broken sedimentary rocks (y3)
Conglomerate
CENTRAL BELT
Melange (cm1)
Broken & locally sheared sedimentary rock
White Rock metasandstone
Limestone
Basaltic rocks
Melange block
Serpentinite
GEOLOGIC MAP OF EASTERN SUBBASIN
Source: Modified from USGS map MF-2336 (2000)

Vegetation

Unless otherwise noted, the vegetation description in this section is based on manipulation of Calveg 2000 data. This is vegetation data interpreted from satellite imagery by the United States Forest Service, Remote Sensing Lab. The minimum mapping size is 2.5 acres.

Mixed hardwood and conifer forests cover 64% of the area, conifer forest 9%, and hardwood forest 16% for a total of eighty-nine percent forested area. Grassland occupies 11% of the subbasin. Shrub, barren, agricultural lands, and urban classifications together cover the remaining 2% of the area. The forested vegetation reflects the impacts of harvesting. Fifty-six percent of the Eastern subbasin is in the 12 to 23.9 inch diameter breast height (dbh) size class. Twenty-one percent is in a diameter size class greater than 24 inches diameter breast height.

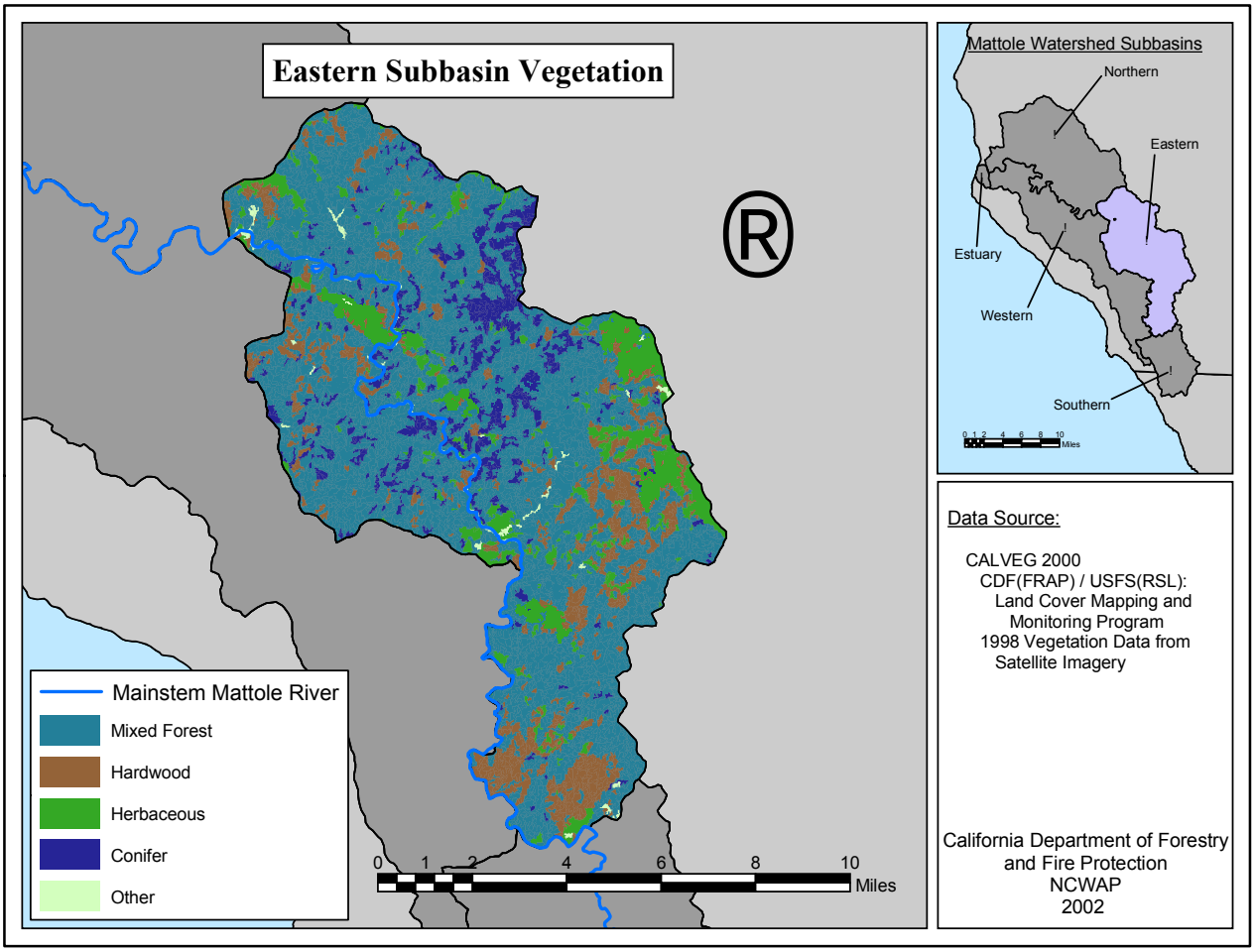


Figure 29: Vegetation of the Eastern Subbasin.

Land Use

The watershed is largely subdivided into back-to-land homesteads (Table 30). About a third of the area is managed for timber production and cattle ranching. The town of Honeydew is located at the downstream end of this subbasin near the confluence of Honeydew Creek and the Mattole River. The hamlets of Ettersburg and Thorn Junction are also located in this subbasin. Fragmentation of these remaining larger land ownerships could be reduced through the procurement of development rights by way of conservation easements, thus alleviating potential negative effects of sub-division development.

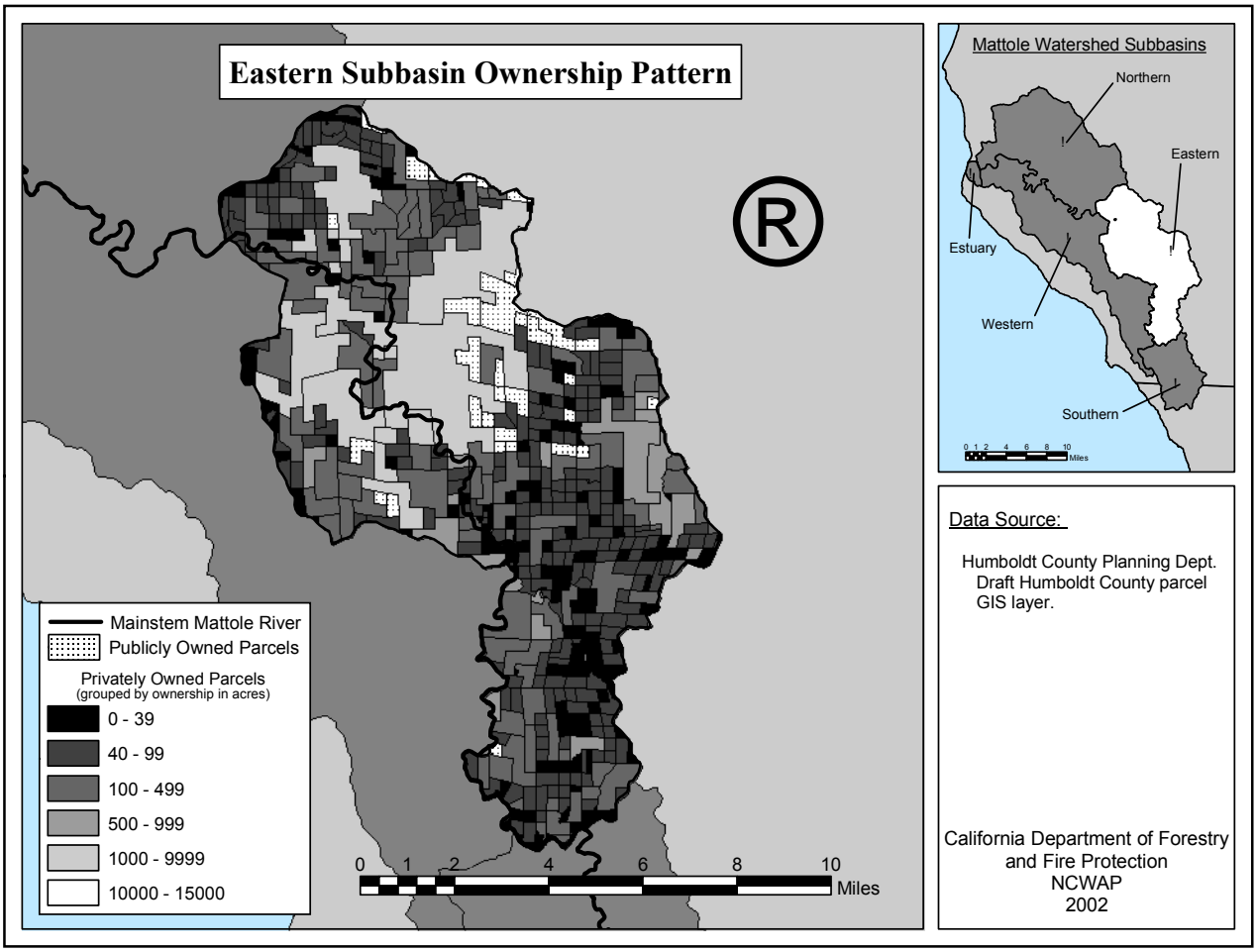


Figure 30: Ownership Pattern of the Eastern Subbasin.

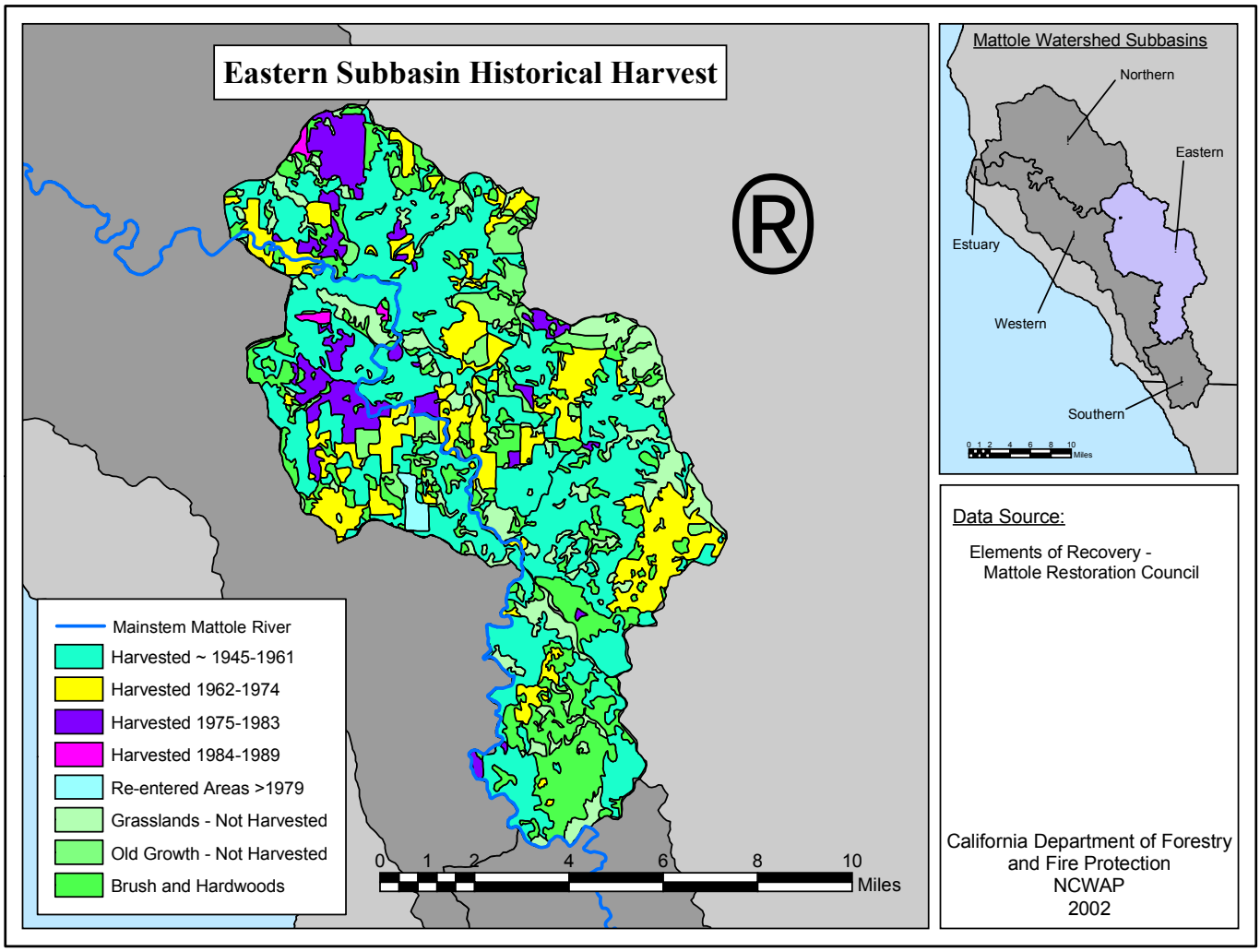


Figure 31: Timber Harvest History for the Eastern Subbasin.

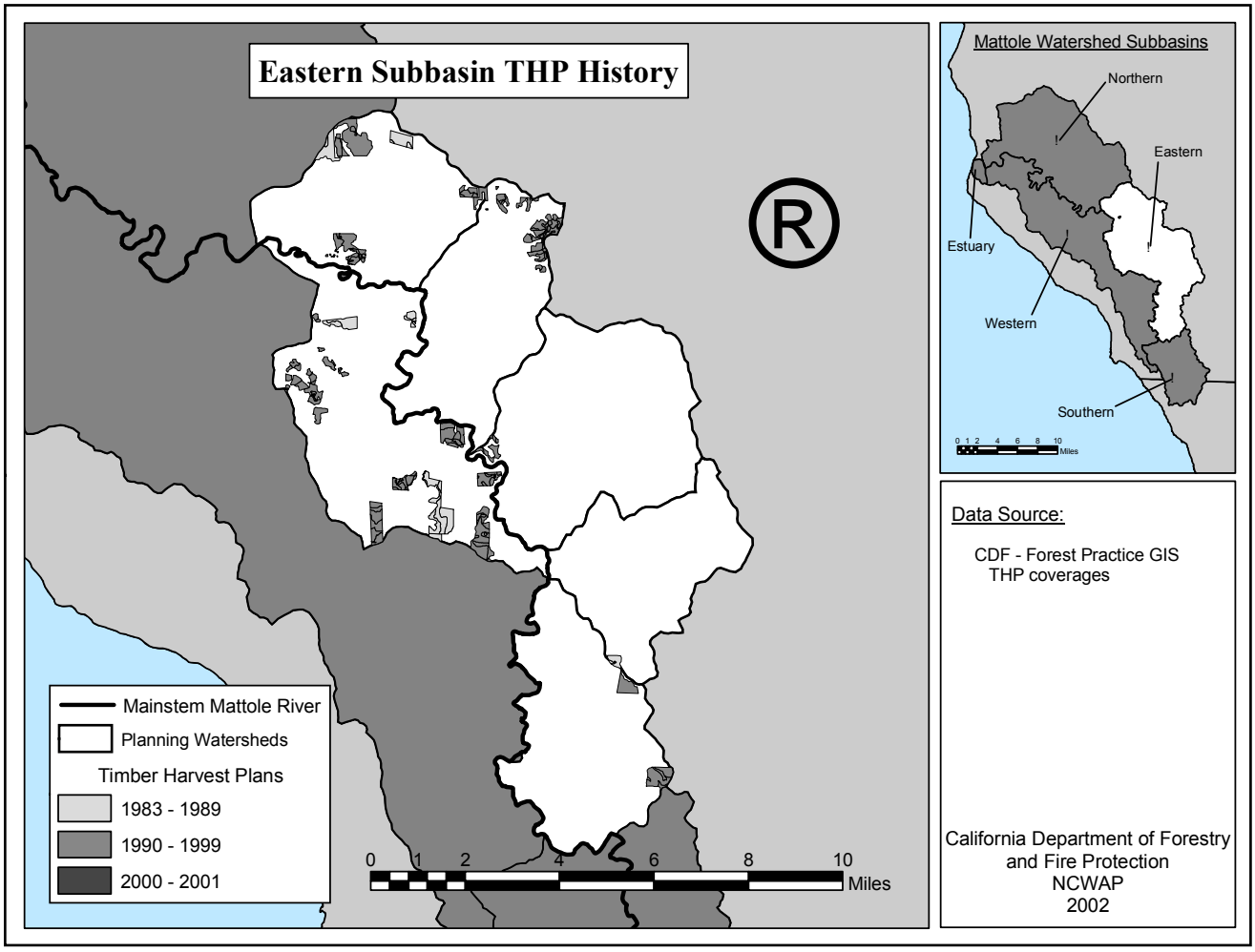


Figure 32: Timber Harvesting Plans History 1983-2001, Eastern Subbasin.

Timber harvesting covered a substantial portion of the basin prior to the 1964 flood. Aerial photograph interpretations of 1941 and 1952 flights show the main activity appears to have been the maintenance of grassland and conversion of forestland to grassland. In many cases, this was accomplished by the use of fire set in standing dead trees that were present in areas with no indication of skid trails for harvesting. Later, as timber harvesting occurred, the logging method was tractor logging down to streamside road systems. The silviculture was a type of seed tree cut that often left brush and some conifer. Timber harvesting activity since 1983 has covered about 5% of the subbasin. There have been only a few timber-harvesting plans filed in the smaller parcel sizes that are now rural subdivisions in the Middle and Westlund creeks' watersheds. Almost all of the acreage harvested utilized an even-aged silvicultural method, including the shelterwood removal step. About eighty percent of the harvested area was tractor logged.

Table 23: Timber Harvest History, Eastern Mattole Subbasin.

TIMBER HARVEST HISTORY - EASTERN MATTOLE SUBBASIN		
	Total Acres	Percent of Area
Harvested 1945-1961	21,431	42%
Harvested 1962-1974	7,639	15
Harvested 1975-1983	3,288	7
Harvested 1984-1989	560	1
Harvested 1990-1999	1,928	4
Harvested 2000-2001 (partial)	0	0

The Eastern subbasin contains an extensive and largely un-surfaced road system to service the rural sub-divisions in the subbasin. These roads are used year round by residents, further elevating the already high production rates of fine sediment into the stream network. This condition is deleterious to stream habitat for salmonids. These impacts, especially in the depositional, lower reaches of the tributaries adversely affects summer juvenile rearing and created less than ideal spawning conditions for adult salmonids.

Fluvial Geomorphology

Historically, the fluvial geomorphology of the Eastern subbasin has been characterized by the highest percentage of mapped channel characteristics, within site-specific areas, throughout the Mattole Watershed. However, the Eastern subbasin can now be characterized as showing the largest reduction in mapped channel characteristics. The planning watersheds (PWs) that make up the Eastern subbasin include: Blue Slide Creek, Dry Creek, Eubank Creek, Mattole Canyon, Sholes Creek, and Westlund Creek.

Table 24 documents the number of sites and summarizes the lengths of eroding bank features within the Eastern subbasin. In general, stream bank erosion has been observed within all but one of the planning watersheds within this subbasin. The number of eroding bank sites range from one in the Mattole Canyon PW to 10 in the Sholes Creek PW. The Sholes Creek PW has been mapped with a total length of approximately 3700 meters of eroding bank; about 10 percent of the stream length within the PW.

Table 24 Eroding Stream Bank Lenghts - Eastern Subbasin Planning Watersheds.

Eastern Subbasin Planning Watersheds	*2000 Photos*			
	Number of Sites w/in PW	Maximum Length (m) of Eroding Bank w/in PW	Total Length (m) of Eroding Bank w/in PW	Approx. % Eroding Bank to Stream Length w/in PW
Blue Slide Creek	0	N.O.	N.O.	N.O.
Dry Creek	7	540	1381	5
Eubank Creek	3	140	279	1
Mattole Canyon	1	90	90	<1
Sholes Creek	10	1130	3700	9
Westland Creek	3	245	484	2

N.O.- Not Observed

Table 24 illustrates the range in mapped channel characteristics, gullies, and lateral bar development from the 1984 and 2000 aerial photographs. In general, the 1984 air photos, for most of the subbasin, reveal that mapped channel characteristics range from 90 to less than 50 percent of the overall channel length; gullies range from 10 to less than 5 percent of the overall containing area; and lateral bar development ranges from intermediate to high values within subreach lengths. However, the 2000 air photos show that every PW within the Eastern subbasin has shown a significant decrease in mapped channel characteristics, with no significant change in the number of gullies. In fact two PWs, Blue Slide and Westlund Creeks, have demonstrated a dramatic reduction in lateral bar development, which suggests a decrease in excess sediment. The most noteworthy example of a decrease in mapped channel characteristics is illustrated in the Sholes Creek PW; where the highest values have decreased from 90 to 35 percent between 1984 and 2000.

Table 25: Fluvial Geomorphic Features - Eastern Mattole Subbasin.

	2000 Photos			1984 Photos		
Planning Watersheds	% Disturbed Channel [1]	% Gullies [2]	Lateral Bar Development [3]	% Disturbed Channel [1]	% Gullies [2]	Lateral Bar Development [3]
Blue Slide Creek	<5	<10	1	<50-80	<10	3-5
Dry Creek	<10-40	<5	2-4	<50-80	<2	3-5
Eubank Creek	<10	<10	1	15-25	<10	1
Mattole Canyon	<10-40	<10-15	3-4	<50-80	<5-10	3-5
Sholes Creek	<15-35	<10	3-4	<50-90	<10	3-5
Westland Creek	<10-25	<5-10	3	<50-80	<5	3-5

All values are visual approximations at this stage and subject to change as GIS data becomes available.

[1] Features include: lack of riparian vegetation, distribution and number of lateral or mid-channel bars, multi-thread channels, cut-off chutes, channel bank erosion, and shallow landslides adjacent to or blocking channels.

[2] Gullies include those that appear active, have little to no vegetation within the incised area, and are of sufficient size to be identified on aerial photos.

[3] Lateral bars include mappable lateral, mid-channel bars and reflect sediment supply and storage. Rankings range from 1-5. Higher values suggest excess sediment

A sizeable area of sediment deposition was observed along Dry Creek immediately up stream from a large slide. This area of deposition has been attributed to backwater effects along Dry Creek which are related to this large persistent slide acting as a hydrologic point of constraint. The mouth of Mattole Canyon is another location, which has been a long-term area of sediment accumulation. This can be attributed to weak rocks and numerous slides up canyon and a reduction of gradient near the area of deposition.

Aquatic/Riparian Conditions

Unless otherwise noted, the vegetation description in this section is based on manipulation of Calveg 2000 data. This is vegetation data interpreted from satellite imagery by the United States Forest Service, Remote Sensing Lab. The minimum mapping size is 2.5 acres.

Vegetation within 150 feet of the centerline of streams is 70% mixed conifer and hardwood forest, 11% hardwood, 9% conifer forest, 4% annual grassland and 5% barren while shrubs, water, agricultural and urban combined make up the remaining 1%. The large percentage of barren occurs primarily along the Mattole River downstream of the confluence of Mattole Canyon and the Mattole River, the downstream portion of Mattole Canyon and in Dry Creek. Fifty-eight percent of the riparian area is covered by trees in the 12 to 23.5 inch diameter size class. The area occupied by this single-width zone is 13% of the total Eastern Subbasin acreage.

Fish Habitat Relationship

Historically, the Eastern Subbasin supported runs of chinook salmon, coho salmon, and steelhead trout. Interviews with local residents describe Eubanks Creek as the "finest" salmon stream in the area (Coastal Headwaters Association 1982). DFG stream surveys in the 1960s found steelhead trout in five streams, unidentified salmonids in eight streams, and coho salmon in Westlund Creek and Harrow Creek. High densities of steelhead trout were estimated for McKee Creek (300 per 100 feet of stream) in August 1966.

A study of the standing stock of Mattole Basin salmonids conducted in July and August 1972 (Brown, 1973b) examined two streams in the Eastern Subbasin, Mattole Canyon Creek and McKee Creek. A coho salmon was found in Mattole Canyon Creek. Steelhead trout were found at densities of 608 per 100 feet of stream in Mattole Canyon Creek, 67 per 100 feet of stream in McKee Creek 1.0 mile above its mouth, and 209 per 100 feet of stream in McKee Creek near its mouth.

BLM, Coastal Headwaters Association, and DFG stream surveys have continued to document the presence of steelhead trout in most streams in the Eastern Subbasin over time. BLM surveys of Dry Creek and Sholes Creek in 1977 found many juvenile steelhead trout. Coastal Headwaters Association surveys in 1981 and 1982 found steelhead trout in Dry Creek, Eubanks Creek, Sinkyone Creek, McKee Creek, and Painter Creek. DFG surveys found steelhead trout in Four Mile Creek in the 1980s and Middle Creek, Westlund Creek, Gilham Creek, Four Mile Creek, Harrow Creek, Grindstone Creek, Eubanks Creek, and McKee Creek in the 1990s.

Unidentified salmonid adults were found in McKee Creek and Painter Creek in January 1985 by DFG. These could have been chinook or coho salmon. Although coho salmon were not detected in any 1990s DFG stream surveys in this subbasin's streams, they were found by a Redwood Sciences Lab study in Eubanks Creek in 1995. However, a 1997-99 Redwood Sciences Laboratory study of juvenile coho salmon distributions in relation to water temperatures in the Mattole Basin (Welsh et al. 2001) did not find coho salmon in Eubanks Creek, Westlund Creek, Mattole Canyon Creek, or Blue Slide Creek. The 2001 DFG Coho Inventory also found coho salmon in Four Mile Creek, Sholes Creek, and Grindstone Creek. More detailed summaries of stream surveys and fisheries studies in the Eastern Subbasin are provided in the DFG Appendix.

Fish History and Status

Based on limited fish sampling, few coho and no chinook have been found in tributary surveys. In 2001, the DFG Coho Assessment staff found coho in two streams in the subbasin. Steelhead populations are well distributed and are represented with diverse age classes. Additional sampling is needed to better determine the distribution and abundance of salmonids throughout this area.

Fish Passage Barriers

One stream crossing was surveyed in the Eastern Subbasin as a part of the Humboldt County culvert inventory and fish passage evaluation conducted by Ross Taylor and Associates (2000). Shelter Cove Road has a culvert on Painter Creek. This culvert was found to be a partial and temporary salmonid barrier (Table 26). Priority ranking of 67 culverts in Humboldt County for treatment to provide unimpeded salmonid passage to spawning and rearing habitat placed the culvert on Shelter Cove Road at rank 10. Criteria for priority ranking included salmonid species diversity, extent of barrier present, culvert risk of failure, current culvert condition, salmonid habitat quantity, salmonid habitat quality, and a total salmonid habitat score. No improvement of the culvert on Painter Creek is currently proposed (G. Flosi, personal communication).

Table 26: Culverts surveyed for barrier status in the Eastern Subbasin.

Stream Name	*Road Name*	*Priority Rank*	*Barrier Status*	*Upstream Habitat*	*Treatment*
Painter Creek	Shelter Cove Road	10	Temporary and partial barrier. The culvert is a partial and temporary barrier for adults and a total barrier to juveniles. An excessive jump (3-5 ft) is required to enter the culvert. The concrete divider reduces the "target" size of the outflow that fish must jump into for entry.	1.1 miles of good to fair salmonid habitat.	None proposed at this time

Habitat Summary

The Eastern Subbasin EMDS evaluations were determined by calculating a mean, area weighted watershed condition value from the Dry Creek, Westlund Creek, Mattole Canyon, Blue Slide Creek, Eubank Creek, and Sholes Creek Calwater 2.2 Units. The evaluation results of each subbasin are presented in the EMDS section of the Mattole River Watershed Profile. The overall condition of the Calwater 2.2 Units were determined by the results of the following level one network factors:

- Passage Barriers (currently with no data in this subbasin)
- Upland Condition
- Road Condition
- Stream Condition

Evaluating the suitability of each of these four watershed condition factors that affect salmon and steelhead provides the degree of subbasin suitability for the fish. The condition of each of these factors, in turn, is determined by evaluating the suitability of the many watershed condition variables that affects it. In all, there are four nested tier levels in the EMDS suitability analysis system. The EMDS system is not predictive, but rather functions as a dynamic filing system to isolate and evaluate the many detailed variables operating in a watershed. These variables are combined in the system much like they interact in the watershed itself.

Each individual variable at level four, the deepest tier, is assigned an evaluation rating between –1 (fully unsuitable) and +1 (fully suitable) compared to known standards that produce conditions that are either good or bad for salmonids. These condition values are passed up through the network according to their power to develop, restrict, or over-ride conditions affecting fish population health. For

example, water is the most restrictive variable for fish. Regardless of suitable conditions for other factors like shade canopy, clean gravel, large woody debris, and pool depth, a lack of water over-rides those good conditions and makes the overall result unsuitable for fish. The arrangement of the factors in the system and the way they are combined allows this sort of variable interaction. This functional model provides analysts the capacity for orderly assessment of the watershed's condition. (Figure 5, page 43). Network details are described in Appendix **A** and maps showing EMDS results are provided in Appendix **B**.

The system can be structured to operate with watersheds of various scales from basin level to stream reaches. NCWAP operated the system at the basin, subbasin, Calwater planning watershed, and stream reach scales. Regardless of scale or the ultimate suitability rating an assessment produces, the system allows for backtracking to find the factors that have affected the suitability rating. As such, the system is useful for the identification of watershed improvement opportunities. It is also good at identifying areas of refugia and resources that need protective measures during land use activities.

The system evaluates conditions at a particular moment in time and is static in its analysis. However, it also can be useful for recording changes in watershed factor conditions as discovered through new field assessments or a series of monitoring activities. Changes in suitability of conditions for fish due to both natural processes and restoration efforts can be evaluated in this fashion. Multiple system "runs" over time can therefore document change and be useful for trend analysis. Thus, the ultimate "suitability" ratings are somewhat secondary in importance to the utility of the system for detailed watershed factor condition assessment, diagnostics, and development of recommendations for watershed improvement activities.

The overall watershed condition rating from the EMDS model was moderately unsuitable for the Eastern Subbasin. Watershed conditions in the six Calwater Units ranged from somewhat unsuitable in the Sholes Creek and Westlund Creek Calwater Units to fully unsuitable in the Dry Creek and Blue Slide Creek Calwater Units (Table 27).

Data on fish passage barriers has not yet been incorporated into EMDS. However, this data is presented in the Fish Passage Barriers section of the Eastern Subbasin Overview. A culvert on Shelter Cove Road was found to be a partial and temporary salmonid barrier. This culvert is on Painter Creek in the Eubank Creek Calwater Unit.

Upland condition in the Eastern Subbasin was rated somewhat unsuitable by EMDS. All Calwater Units in the Subbasin had either moderately or fully unsuitable upland conditions except for the Blue Slide Creek Calwater Unit where the upland condition was undetermined. Fully suitable ratings for early seral were balanced by somewhat to fully unsuitable ratings for upland cover and canopy in all Calwater Units. Land use ratings ranged from somewhat suitable to fully unsuitable and slope stability ratings ranged from fully suitable to moderately unsuitable.

Road condition in the Eastern Subbasin was rated somewhat suitable by EMDS. Road condition ratings ranged from moderately suitable in the Mattole Canyon, Shole Creek, and Westlund Creek Calwater Units to somewhat unsuitable in the Blue Slide Creek and Eubank Creek Calwater Units. Road use was undetermined in all Calwater Units while ratings for road density unstable ranged from fully suitable to somewhat unsuitable. Ratings for stream crossings, road density by hillslope position, and road proximity ranged widely.

Stream condition in the Eastern Subbasin was rated moderately unsuitable by EMDS. Data on water temperature and stream flow have not yet been incorporated into EMDS. However, water temperature data is presented in the North Coast Water Quality Control Board Appendix and stream flow data is presented in the Department of Water Resources Appendix and in individual stream survey report summaries (Appendix X). Temperature records were available for Westlund, Mattole Canyon, Blue Slide Creek, and Eubanks Creeks. Westlund Creek, Mattole Canyon Creek, Blue Slide Creek, and Eubanks Creek are in the Calwater Units that bear their names. All MWATs for these four tributaries

from 1996-2001 were above the 50-60^{o} F range for optimal coho growth, except Eubanks Creek at 59.7 ^{o} F during 2001. Riparian ratings ranged from somewhat suitable in the Sholes Creek Calwater Unit to fully unsuitable in the Dry Creek and Blue Slide Creek Calwater Units. Reach condition was somewhat unsuitable in the Sholes Creek, Westlund Creek, Blue Slide Creek, and Eubank Creek Calwater Units, and moderately unsuitable in the Dry Creek and Mattole Canyon Calwater Units.

In the Mattole Basin, the Ecological Management Decision Support system (EMDS) evaluated four main condition factors:

Passage Barriers,

Upland Condition,

Road Condition,

and **Stream Condition**.

Of these, Upland, Road, and Stream Condition values are products of several condition factors, which are also listed in Table X. Finally, all four main factors are combined to produce an **Overall Watershed Condition** value. Please refer to a detailed explanation of EMDS on page 37.

Key:

+++	Fully suitable
++	Moderately suitable
+	Somewhat suitable
U	Undetermined
-	Somewhat unsuitable
--	Moderately unsuitable
---	Fully unsuitable

Table 27: EMDS Watershed Suitability Ratings for the Eastern Subbasin by CalWater 2.2 Unit.

Watershed Unit / Condition Factor	Eastern Subbasin	Dry Creek	Mattole Canyon	Sholes Creek	Westland Creek	Blue Slide Creek	Eubank Creek
Passage Barriers	**U**	**U**	**U**	**U**	**U**	**U**	**U**
Upland Cover	**- -**	**- - -**	**- - -**	**- - -**	**-**	**- - -**	**- - -**
Canopy	**- -**	**- - -**	**- - -**	**- - -**	**-**	**- - -**	**- - -**
Early Seral	**+++**	**+++**	**+++**	**+++**	**+++**	**+++**	**+++**
Slope Stability	**++**	**- -**	**+**	**U**	**-**	**+++**	**++**
Land Use	**-**	**- -**	**-**	**- - -**	**- -**	**-**	**+**
Upland Condition	**-**	**- -**	**-**	**-**	**-**	**U**	**-**
Road Use	**+**	**U**	**U**	**U**	**U**	**U**	**U**
Stream Crossings	**+**	**+++**	**++**	**+++**	**+**	**- - -**	**-**
Road Density By Hillslope Position	**+**	**+**	**+++**	**+**	**++**	**- - -**	**- - -**
Road Density Unstable	**++**	**- - -**	**+++**	**++**	**++**	**+++**	**+++**
Road Proximity	**+**	**+++**	**++**	**+++**	**++**	**- - -**	**- - -**
Road Condition	**+**	**+**	**++**	**++**	**++**	**-**	**-**
Stream Flow	**U**	**U**	**U**	**U**	**U**	**U**	**U**
Riparian	**- -**	**- - -**	**- -**	**-**	**- -**	**- - -**	**- -**
Reach Condition	**-**	**--**	**--**	**-**	**-**	**-**	**-**
Stream Condition	**- -**	**- - -**	**- -**	**-**	**- -**	**- - -**	**- -**
Overall Watershed Condition	**- -**	**- - -**	**- -**	**-**	**-**	**- - -**	**- -**

Reach condition was assessed by EMDS using stream attributes such as canopy cover, embeddedness, percent pools, pool depth, and pool shelter. These attributes were collected in fourteen streams in the Eastern Subbasin by DFG (see Appendix X for stream survey report summaries). Dry Creek and Middle Creek are in the Dry Creek Calwater Unit. Westlund Creek, Gilham Creek and unnamed tributary to Gilham Creek are in the Westlund Creek Calwater Unit. Four Mile Creek, NF Four Mile Creek, Sholes Creek and Harrow Creek are in the Sholes Creek Calwater Unit. Fire Creek is in the Blue Slide Creek Calwater Unit. Grindstone Creek and Little Grindstone Creek are in the Mattole Canyon Calwater Unit and Eubanks Creek and McKee Creek are in the Eubank Creek Calwater Unit.

Stream attributes tend to vary with stream size. For example, larger streams generally have more open canopy and deeper pools than small streams. This is partially a function of wider stream channels and greater stream energy due to higher discharge during storms. Surveyed streams in the Eastern Subbasin ranged in drainage area from 0.6 to 5.5 square miles (Figure 33).

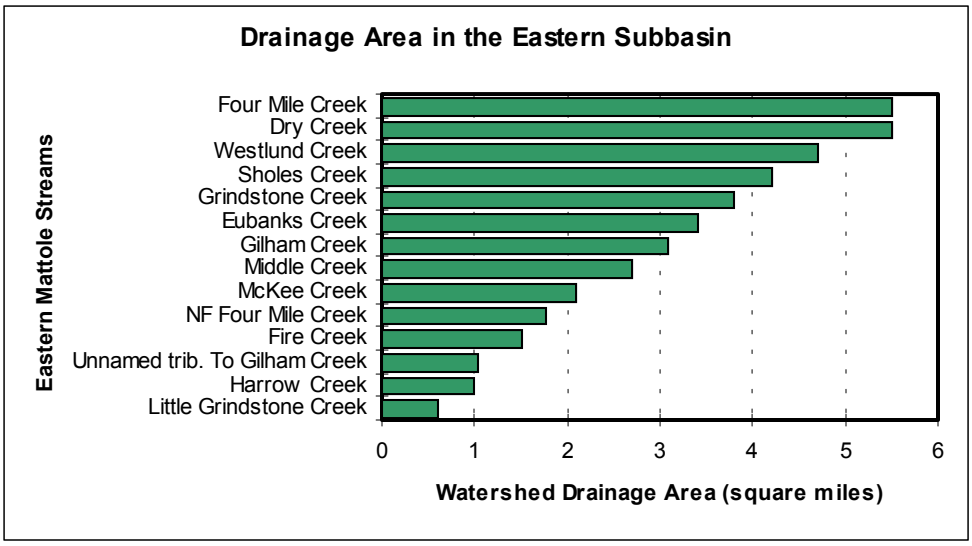


Figure 33: Drainage Area of Stream Surveyed by DFG in Eastern Subbasin.

Canopy cover, and relative canopy cover by coniferous versus deciduous trees were measured at each habitat unit during DFG stream surveys. Near-stream forest density and composition contribute to microclimate conditions that help regulate air temperature, which is an important factor in determining stream water temperature. Furthermore, canopy levels provide an indication of the potential present and future recruitment of large woody debris to the stream channel, as well as the insulating capacity of the stream and riparian areas during winter.

In general, the percentage of stream canopy cover increases as drainage area and therefore, channel width, decrease. Deviations from this trend in canopy may indicate streams with more suitable or unsuitable canopy relative to other streams of that subbasin. As described by the EMDS response curves, total canopy (sum of conifer and deciduous canopy) exceeding 85% is considered fully suitable, and total canopy less than 50% is fully unsuitable for contributing to cool water temperatures that support salmonids. The surveyed streams of the Eastern Subbasin show a wide range of percent canopy levels (49%-99% total canopy) that vary in their EMDS rating from fully suitable to fully unsuitable.

Cobble embeddedness was measured at each pool tail crest during DFG stream surveys. Cobble embeddedness is the percentage of an average sized cobble piece at a pool tail out that is embedded in fine substrate. Category 1 is 0-25% embedded, Category 2 is 26-50% embedded, 51-75% Category 3 is embedded, Category 4 is 76-100% embedded, and Category 5 is unsuitable for spawning due to factors other than embeddedness. Cobble embedded deeper that 51% is not within the fully supported range for successful use by salmonids. The EMDS Reach Model considers cobble embeddedness greater than 50% to be somewhat unsuitable and 100% to be fully unsuitable for the survival of salmonid eggs and embryos. Embeddedness values in the Eastern Subbasin are somewhat unsuitable or worse for the survival of developing salmonid eggs and embryos (Figure 35). However, Figure 35 also illustrates how stream reaches rated as unsuitable overall may actually have some suitable spawning gravel sites distributed through the stream reach.

Pool, flatwater, and riffle habitat units observed were measured, described, and recorded during DFG stream surveys. During their life history, salmonids require access to all of these types of habitat. EMDS does not evaluate the ratio of these habitat types, but a balanced proportion is desirable. Most surveyed Eastern Subbasin tributaries have less than 20% pool habitat by length indicating unsuitable conditions for salmonid rearing and holding (Figure 36). This is well below the range considered fully suitable as described below. Eubanks Creek has the most pool habitat (33%). Dry units were also measured, and obviously indicate poor conditions for fish.

Pool depths were measured during DFG surveys. The amount of primary pool habitat of sufficient depth to be fully suitable for anadromous salmonids is considered in the EMDS Reach Model. Primary pools are determined by a range of pool depths, depending on the order (size) of the stream. Generally, a reach must have 30 – 55% of its length in primary pools for its stream class to be in the suitable ranges (EMDS Table 4). Generally, larger streams have deeper pools. Deviations from the expected trend in pool depth may indicate streams with more suitable or unsuitable pool depth conditions relative to other streams of that subbasin. Eubanks Creek has the highest frequency of deeper pools (Figure EH5), but other streams are unsuitable with respect to pool depth.

Pool shelter was measured during DFG surveys. Pool shelter rating illustrates relative pool complexity, another component of pool quality. Ratings range from 0-300. The Stream Reach EMDS model evaluates pool shelter to be fully unsuitable if less than a rating of 30. The range from 100 to 300 is fully suitable. Pool shelter ratings in Eastern Subbasin tributaries are among the lowest in the Mattole Basin and offer unsuitable pool habitat complexity and cover for anadromous fish (Figure EH6).

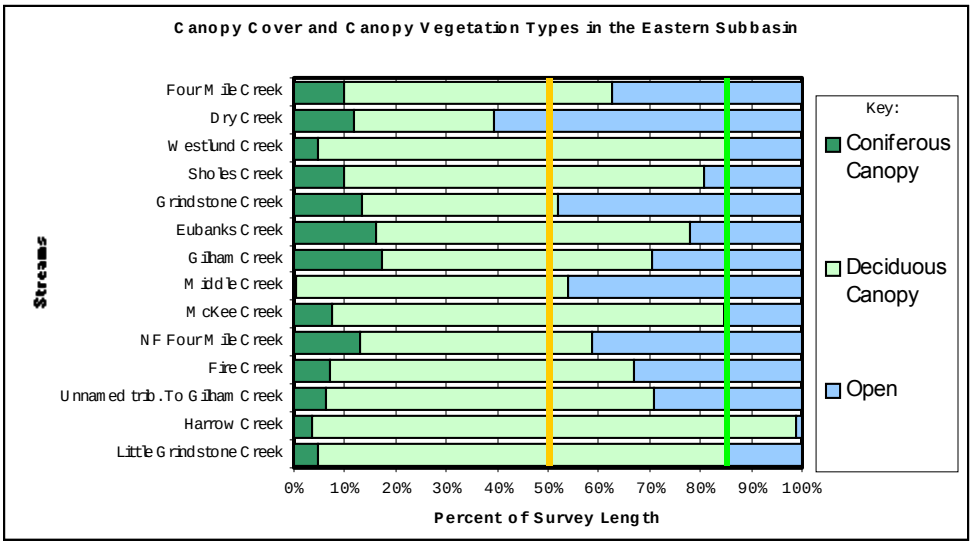


Figure 34: The Relative Percentage of Coniferous, Deciduous, and Open Canopy Covering Surveyed Streams, Eastern Subbasin.

Averages are weighted by unit length to give the most accurate representation of the percent of a stream under each type of canopy. Streams are listed in descending order by drainage area (largest at the top). As described in the EMDS response curves, total canopy (sum of conifer and deciduous canopy) exceeding 85% (green line) is considered fully suitable, and total canopy less than 50% (yellow line) is fully unsuitable for contributing to cool water temperatures that support salmonids.

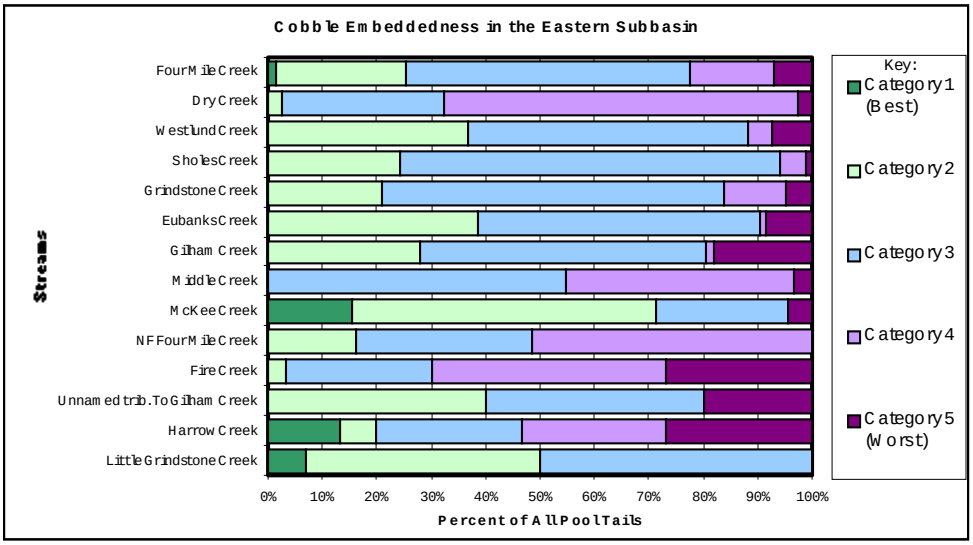


Figure 35: Cobble Embeddedness Categories as Measured at Every Pool Tail Crest in Surveyed Streams, Eastern Subbasin.

Cobble embeddedness is the % of an average sized cobble piece at a pool tail out that is embedded in fine substrate: Category 1 = 0-25% embedded, Category 2 = 26-50% embedded, Category 3 = 51-75% embedded, Category 4 = 76-100%, and Category 5 = unsuitable for spawning due to factors other than embeddedness (e.g. log, rocks). Substrate embeddedness Categories 3, 4, and 5 are considered by EMDS to be somewhat unsuitable to fully unsuitable for the survival of salmonid eggs and embryos. Streams are listed in descending order by drainage area (largest at the top).

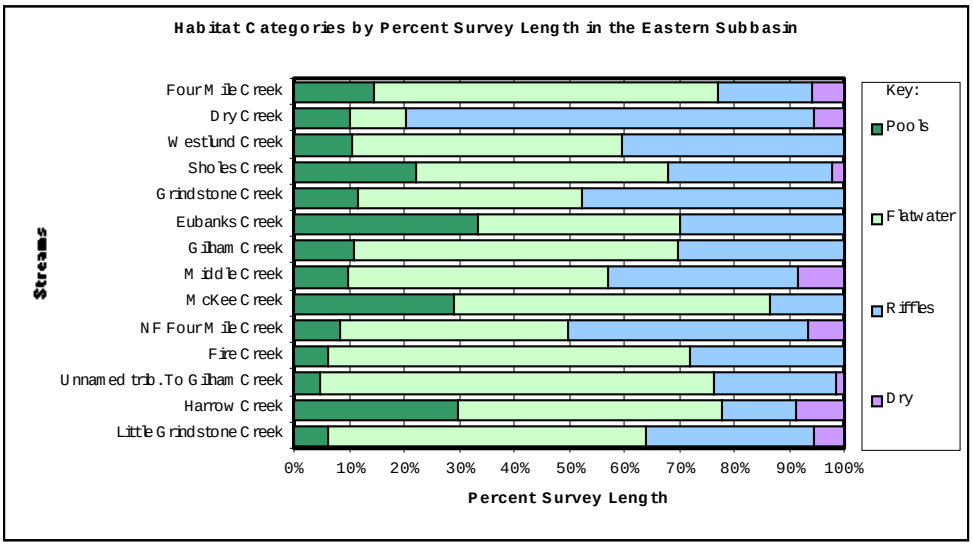


Figure 36: The Percentage of Pool Habitat, Flatwater Habitat, Riffle Habitat, and Dewatered Channel by Survey Length, Eastern Subbasin.

EMDS does not evaluate the ratio of these habitat types, but a balanced proportion is desirable. Streams are listed in descending order by drainage area (largest at the top).

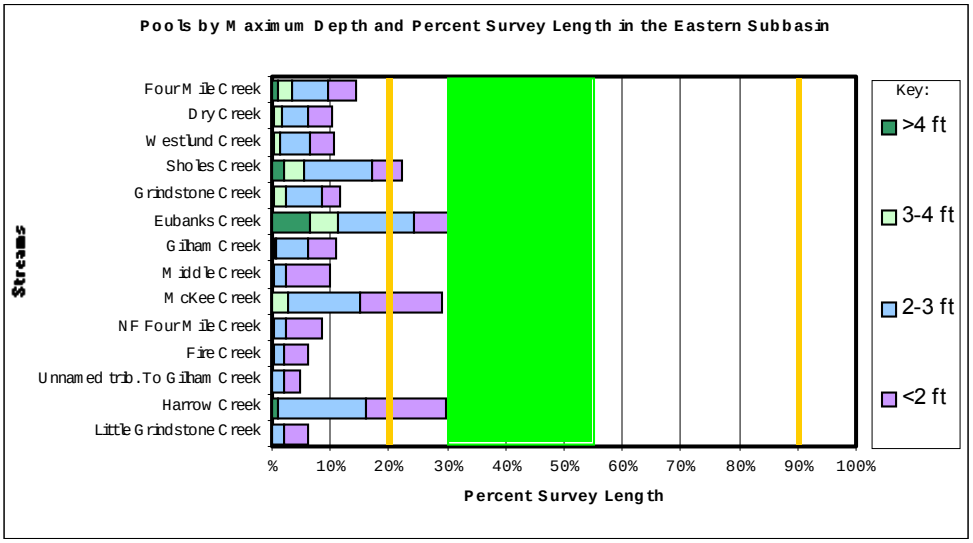


Figure 37: Percent Length of a Survey Composed of Deeper, High Quality Pools, Eastern Subbasin.

Values sum to the length of percent pool habitat in Figure 36. As described in the EMDS response curves, a stream must have 30-55% (green area) of its length in primary pools to provide stream conditions that are fully suitable for salmonids. Streams with <20 % or >90% (yellow lines) of their length in primary pools provide conditions that are fully unsuitable for salmonids. Streams are listed in descending order by drainage area (largest at the top).

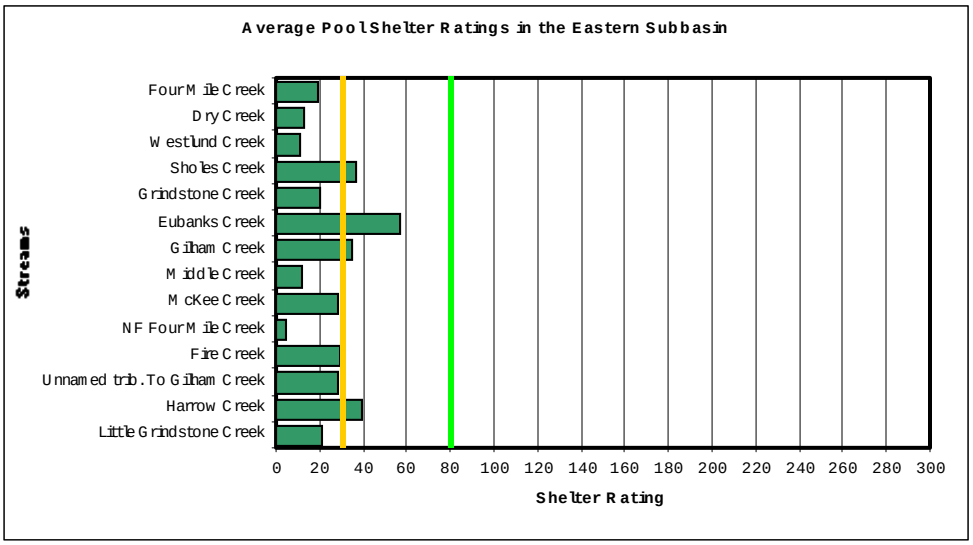


Figure 38: Average Pool Shelter Ratings from DFG Stream Surveys, Eastern Subbasin..

As described in the EMDS response curves, average pool shelter ratings exceeding 80 (green line) are considered fully suitable and average pool shelter ratings less than 30% (yellow line) are fully unsuitable for contributing to shelter that supports salmonids. Streams are listed in descending order by drainage area (largest at the top).

Subbasin Trends

The trends for several factors within the Mattole River tributaries in the Eastern subbasin can be summarized as follows. The size and density of the riparian zone woody vegetation in privately owned timberlands will increase over time due to timber harvesting plan regulations. Those timberlands owned by the public are withdrawn from management activities and the size and density of the riparian zone woody vegetation is also expected to increase over time. There is no trend that can be inferred in vegetation change for riparian areas that are bordered by grasslands. Humboldt County requires new construction set-backs from watercourses that will help preserve existing riparian vegetation, but the clearing of vegetation by landowners as part of rural residential living is not regulated outside of the Coastal Zone. Trends for riparian zones bordered by or containing roads are also unclear. It is possible that some roads may be abandoned and riparian vegetation re-established, but many of the roads are County roads, lead to streamside County Roads or access rural residential parcels. Riparian vegetation may be sacrificed in road maintenance activities, both regular and storm induced.

The number of roads within the watershed can be expected to increase as timberlands are harvested for the first time since the application of Forest Practice Rules. These rules and current practices generally require road systems located high on the slope unlike earlier timber harvest and transportation systems that established roads low on the slopes, often near streams. Lands recently purchased for the Gilham Butte reserve that will be in Bureau of Land Management (BLM) ownership and management when transactions are complete will have road assessment and inventory evaluation as part of a change in landowner objectives.

The short time period of stream temperature data results does not allow for any trend analysis. There is no data on suspended sediment.

Disturbed stream channel percent appears to have decreased during the time period of 1984 to 2000. Analysis of previous years has not been undertaken to see if this is a continuing trend. Both the 1955

and 1964 floods were one hundred year return events while all other major storm events in the years 1951-2000, the period of record for the Petrolia stream gauge, hover around the ten year flood event level.

Current estimated populations of chinook salmon and coho salmon throughout the Mattole Basin are low compared to United States Fish and Wildlife Service (USFWS) estimated populations in 1960. Outmigrant trapping of steelhead trout appears to indicate that their population is closer to the 1960 USFWS population estimate. However, not enough quantitative data on any salmonid species exists to establish clear trends on a subbasin basis.

Eastern Subbasin Issues

- Roads – There is concern over abandoned roads and new road construction, and road maintenance issues related to landsliding and sediment input. Without appropriate maintenance or storm proofing, existing roads, both active and abandoned, may continue to supply sediment. Road inventories have been completed for a small portion of this subbasin, and it is recommended that this effort be continued until a complete inventory is compiled.

- This subbasin is heavily sub-divided so that there is high impact on the land from road density, human habitation, land disturbance from building of structures, and land modification, including diversion of surface waters.

- Moderate to large dormant landslides, landslide complexes, and large active landslides were mapped in the soft and to a lesser degree moderate terrains, whereas moderate and occasionally large dormant and small active landslides are scattered throughout the hard terrain (CGS, 2002).

- Debris slide slopes are mapped extensively throughout much of the hard terrain and locally with a lower density and concentration in the moderate terrain. Debris slide slopes are rare in the soft terrain.

- The soft terrain of the mélange matrix and fault/shear zones has been interpreted as having very high landslide potential. The moderate terrain has been assessed as mostly having a moderate landslide potential with some areas of high to very high potential. The hard terrain has been interpreted as mostly in the moderate landslide potential with localized areas of very high potential (CGS, 2002).

- The 2000 air photos show that every planning watershed within the Eastern subbasin has shown a significant decrease in negative channel characteristics, with no significant change in the number of gullies. Blue Slide and Westlund Creeks have demonstrated a dramatic reduction in lateral bar development, which suggests a decrease in excess sediment (CGS, 2002).

- A sizeable area of sediment deposition was observed along Dry Creek immediately up stream from a large slide. This area of deposition has been attributed to backwater effects along Dry Creek which are related to this large persistent slide acting as a hydrologic point of constraint. Backwater effects occur where the stage versus discharge relationship is controlled by the geometry downstream of the area of interest (e.g., a high riffle controls conditions in the upstream pool at low flow (CGS, 2002).

- The mouth of Mattole Canyon is another area that which has been a long-term area of sediment accumulation. This can be attributed to weak rocks and numerous slides up canyon and a reduction of gradient near the area of deposition (CGS, 2002).

- The majority of eroding banks within the Eastern subbasin appear to be located within the Sholes Creek and Dry Creek PWs and along the Mainstem of the Mattole River. The Sholes Creek PW

has the longest total length of eroding bank in the Mattole watershed (as mapped from the 2000 air photos) (CGS, 2002).

- Air photos and field observations show that the Mattole River bordering the Eastern subbasin downstream of the Honeydew landslide is highly aggraded with sediment (CGS, 2002).

- A diesel spill in Blue Slide Creek, reported in April 2000 to the North Coast Regional Water Quality Control Board, is currently undergoing remediation and monitoring by the Board.

- Water temperatures – Available data suggests that summer high temperatures exceed fully suitable conditions throughout much of this subbasin in the lower depositional reaches of most tributaries. Mattole Canyon Creek has elevated temperatures in most of its reaches.

- Large woody debris recruitment potential is generally adequate for the majority of this subbasin with the exception of the grassland areas high along the eastern margins.

- Based on limited summertime fish samples, few coho have been found in tributary surveys. In 2001, the DFG Coho Assessment Project staff found coho in three streams in the subbasin. Steelhead populations are well distributed and are represented with diverse age classes. Additional sampling is needed to better determine the distribution and abundance of salmonids throughout this area.

- Instream habitat diversity and complexity – Based on available data, instream habitat appears to be insufficiently diverse. In many streams inadequate pool depth and a lack of cover and large woody debris have contributed to a simplification of instream fish habitat.

- In order to protect privacy while developing data, the possibility of training local landowners to survey their own streams to conduct salmonid population status surveys would be advisable to help determine fish populations throughout this subbasin.

Eastern Subbasin Issue Synthesis

Working Hypothesis 1:

SUMMER STREAM TEMPERATURES IN MANY SUBBASIN TRIBUTARIES ARE NOT WITHIN THE RANGE OF TEMPERATURES THAT ARE FULLY SUITABLE FOR HEALTHY ANADROMOUS SALMONID POPULATIONS.

Supportive Findings:

- Based on samples taken from 1996-2001, all maximum weekly average temperatures (MWATs) for Westlund Creek, Mattole Canyon Creek, Blue Slide Creek, and Eubanks Creek were above the 50-60ºF range considered suitable for coho growth in the EMDS analysis (except Eubanks Creek in 2001).

- Low canopy density levels appear to result from riparian cover depletion associated with land use, and stream widening due to high sediment inputs, especially during the 1955 and 1964 flood events.

Working Hypothesis 2:

TRIBUTARY CONDITIONS IN THE EASTERN SUBBASIN ARE THE MOST VARIABLE IN THE MATTOLE BASIN CONCERNING WATER TEMPERATURE, HABITAT DIVERSITY, AND SEDIMENT PRODUCTION.

Supportive Findings:

- The DFG Coho Assessment Project found coho salmon in three subbasin tributaries with good habitat and favorable water temperatures in 2001.

- However, four tributaries had water temperatures that were not in the suitable range for salmonids.

- Air photos and field observations show that the Mattole River bordering the Eastern subbasin downstream of Honeydew Creek is highly aggraded with sediment. (CGS, 2002)

Recommendations:

1. Where current canopy is inadequate and site conditions are appropriate, use tree planting and other vegetation management techniques to hasten the development of denser and more extensive riparian canopy.

2. Monitor 24-hour summer water and air temperatures to detect trends using continuous monitoring thermographs.

3. Encourage the monitoring of in-channel sediment and tracking of aggraded reaches in the lower basin by establishing monitoring stations and training personnel.

4. Based upon the latest science on placement of large woody debris in stream channels, managers in the Eastern subbasin should work to improve channel structure and function for salmonids.

5. Continue efforts to conduct and implement road and erosion assessments such as in the Dry and Westlund planning watersheds. Initiate road improvements and erosion proofing throughout the subbasin to reduce sediment delivery.